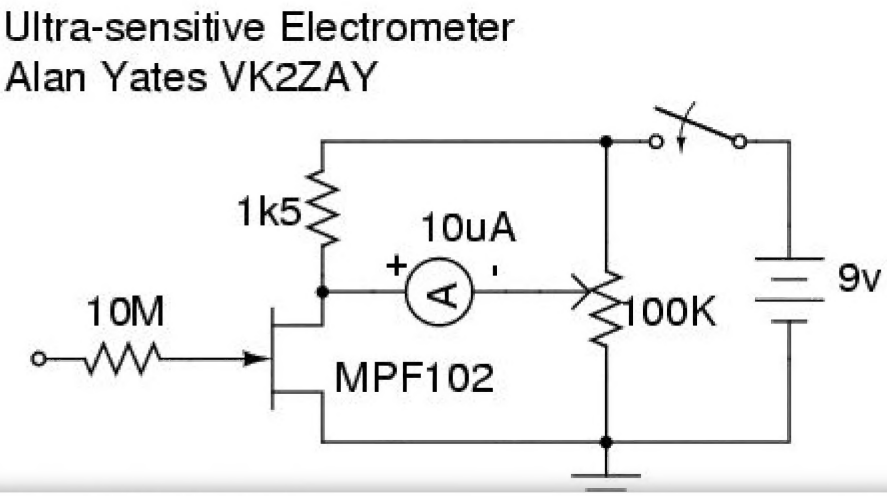
Simple Electrometer

2002-11-16

A trivial JFET electrometer isn't a new idea, there are millions of designs for them out on the Internet, this is just yet another. This one is slightly unique in that it is a bridge configuration that makes it ultra-sensitive, much more so than a gold-leaf electroscope, but less than a vacuum tube or electrometer grade FET device.

When the unit is first switched on the pot is adjusted to give a half-scale reading on the meter. You may wish to have a centre-neutral nulling meter, but I only had the conventional meter in the junk box. I used a 10uA FSD meter which makes the electrometer fantastically sensitive, probably too sensitive at times, and difficult to null. A plastic pen rubbed against your hair slams the needle at more than 2 feet away.



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A selection of shunts or another pot across the meter would enable sensitivity adjustment. The 10M gate resistor is not strictly needed, but helps to protect the FET gate. Changing the value of the pot would effect the sensitivity and may be required if different FSD current meters are used. The 10uA FSD meter is the most sensitive DSE carry. The PCB material the device is built on is copper clad on both sides, this forms the ground connection and gives the electrometer a ground reference. Both sides are interconnected for good grounding.

You can charge the gate by induction slightly, which may give more range in both polarities. If you do charge the gate it will slowing leak away, but this takes a fair while. If you accidentally touch the gate with a charged object and excessively charge it slamming the needle, just touch one finger to the ground plane and another to the electrode to return the gate to a relatively neutral state.

The gate is sensitive enough to sense the electric field of a 9v battery or charged capacitor waved near the electrode. A good demonstration is to take a few nano capacitor with long leads, preferably axial, short it to discharge it completely. Wave both leads near the terminal and little deflection should be observed, just the usual effect of your body near the electrode. Now hold it by one lead, touch the ground plane of the electrometer with your other hand and the other lead of the capacitor to the +ve terminal of the electrometer's 9v battery for a second or so. Now remove it and holding it by one lead approach the electrometer electrode with the other capacitor lead, the needle should deflect a bit in one direction. Next carefully let go of the lead you are holding, say by taking hold of its body encapsulation with your other hand, then take hold of the other lead and again approach the electrometer electrode, it should deflect in the opposite direction. Now hold both leads to discharge the capacitor and try each end again to confirm its discharge.

It is quite amazing to watch it respond to you scuffing your feet on carpet while standing a meter or so away. My coke can Van de Graaff Generator slams the needle from across the room. It will respond to the difference between you touching the floor with your feet while sitting and not touching it, waving your arms around, or approaching the device and taking a step back. If you have a suitable UV light or other ionizing radiation source you can watch it discharge a charged object near the electrode. A thoriated gas lighting mantel discharges a pen cap in a few minutes.

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